Covered Electronic Waste Recycling Program

CRT AND CRT GLASS MANAGEMENT

THE CHALLENGE OF COMPLIANT DISPOSITION

February 10, 2016

Jeff Hunts, Manager, CalRecycle E-waste Program
916-341-6603 jeff.hunts@calrecycle.ca.gov

IN THE BEGINNING…

- In response to a 2001 inquiry, DTSC confirmed CRT devices are hazardous when disposed
- De facto municipal landfill ban on CRT devices
- Local government burdened by providing diversion
- Electronic Waste Recycling Act of 2003
  - SB 20 by Senator Sher, immediately amended by SB 50 in 2004

THE ELECTRONIC WASTE RECYCLING ACT OF 2003

Covered Electronic Waste (CEW) Program

- Intended to fund the end-of-life management of certain video display devices (TVs, monitors)
- Decrease inappropriate disposal
- Improve compliance with State hazardous waste rules
- Return resources to economic mainstream

CEW PROGRAM ACCOMPLISHMENTS

How much (collector transfers to recyclers)?

~ 176 million pounds in 2014

- ~2.6 million units

~ 153 million pounds in 2015

- ~2.3 million units

~ 1.9 billion pounds total since 2005

By who?

~ 4% by local government

~ 26% by designated collectors*

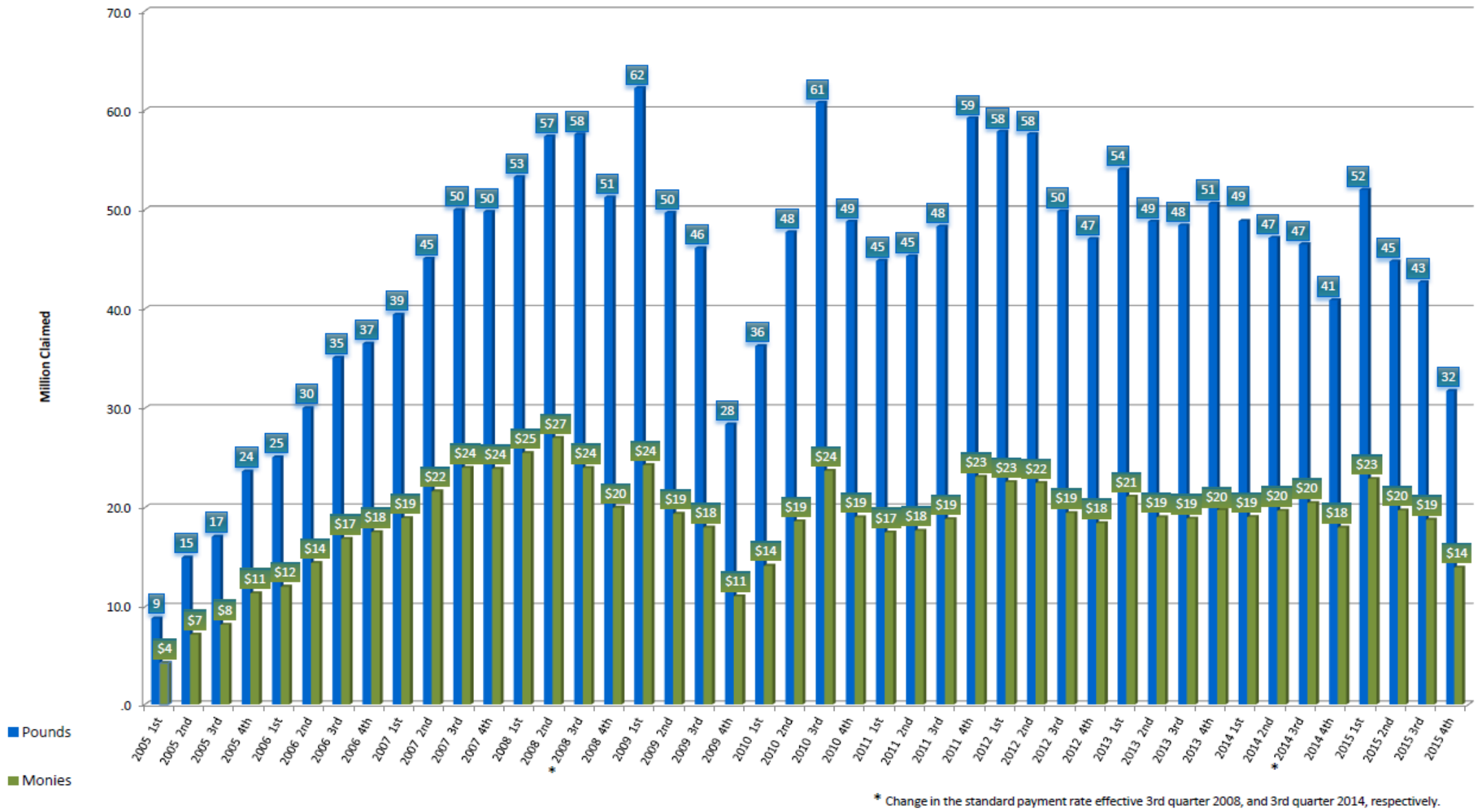
~ 70% by private enterprise

* Form 303 implications?

Covered Electronic Waste Recycling Payment System

Quarterly Monies and Pounds Claimed

(as of February 4, 2016)



* Change in the standard payment rate effective 3rd quarter 2008, and 3rd quarter 2014, respectively.

CRT / GLASS…

Why do we care about residual CRTs / glass?

- **Significant volume**
  - Proxy tracking of CEW volumes
- **Regulated material**
  - Proper management required under UW rule / HW law
- **Must be “shipped” before CEW is claimed**

CRT / GLASS…

Before filing a covered electronic waste (CEW) recycling payment claim:

- CEW recycler must compliantly ship residual CRTs to a destination "authorized" to receive and further treat that material

As part of CEW claim, recycler must:

- Provide shipping, destination, and disposition documents (as applicable)
- Disposition determines regulated pathway

TIMES HAVE CHANGED…

In 2005, there were ready markets for CRTs / glass

- CA was not competing with two dozen other states for options
- CRT manufacturing still occurred

Over time, "destinations" began to eclipse dispositions

- Fostered by recyclers' need to ship CRTs / glass
- Regulation of "destinations" often beyond CA jurisdiction

SUMMARY OF CRT / GLASS INITIAL DESTINATIONS

Amandi Services Inc

ARC International

Closed Loop Refining and Recovery

Com2 Computer & Tech Inc.

Computer Recyclers of America

CRT Processing Corporation

Direct Computer Disposal

Dlubak Glass Co.

Doe Run Company

Dow Management LLC

e-Recycling of California Irvine

E-World Recyclers

Ecoglass Recycling, Inc.

ECS Refining

Electronic Recyclers International

Elltong Subic, Inc.

Envirocycle/Nxtcycle

Glencore Canada Corporation

GLS Group

Hankuk Electric Glass (HEG) Co., Ltd.

LG-Phillips Displays

Met-Mex Penoles, S.A. de C.V.

Noranda Inc. Brunswick Smelter

NovoTec Recycling, LLC

PC Recycle

Regenesys Glass Processing LLC

Samsung Corning (Malaysia)

Samtel Glass Limited

Source Glass Recycling

Source-Loyalty Recycling Mexicana S. De

Technologies Display Mexicana, SA de CV

Tianjin Loyalty Glass Materials Co., Ltd.

Universal Recycling Technologies

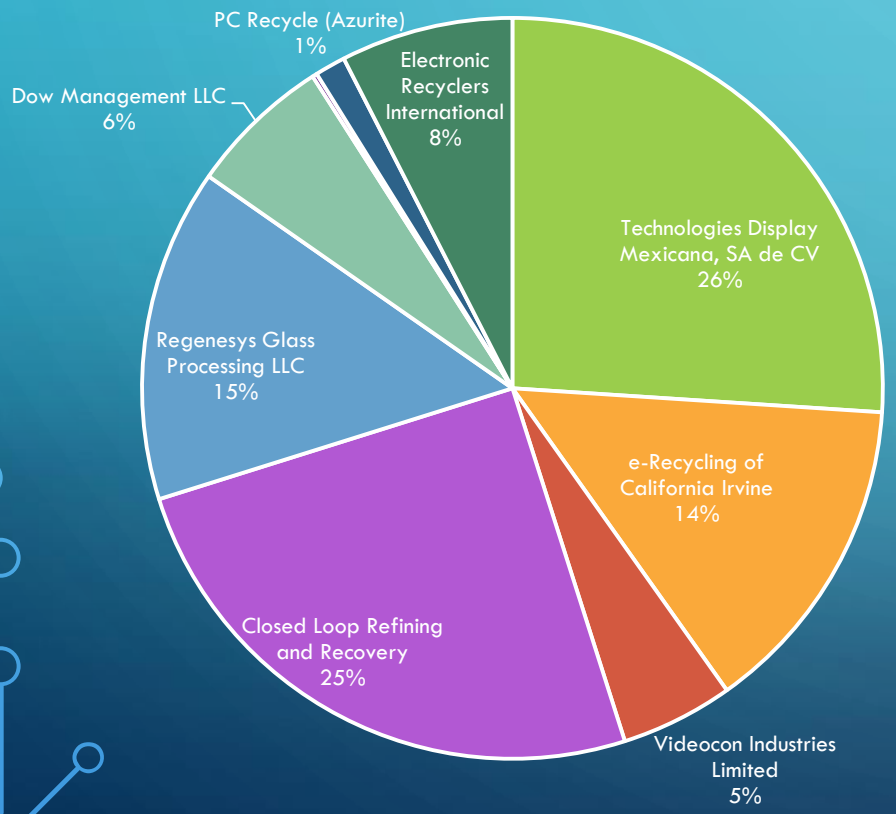
US Ecology

Videocon Industries Limited

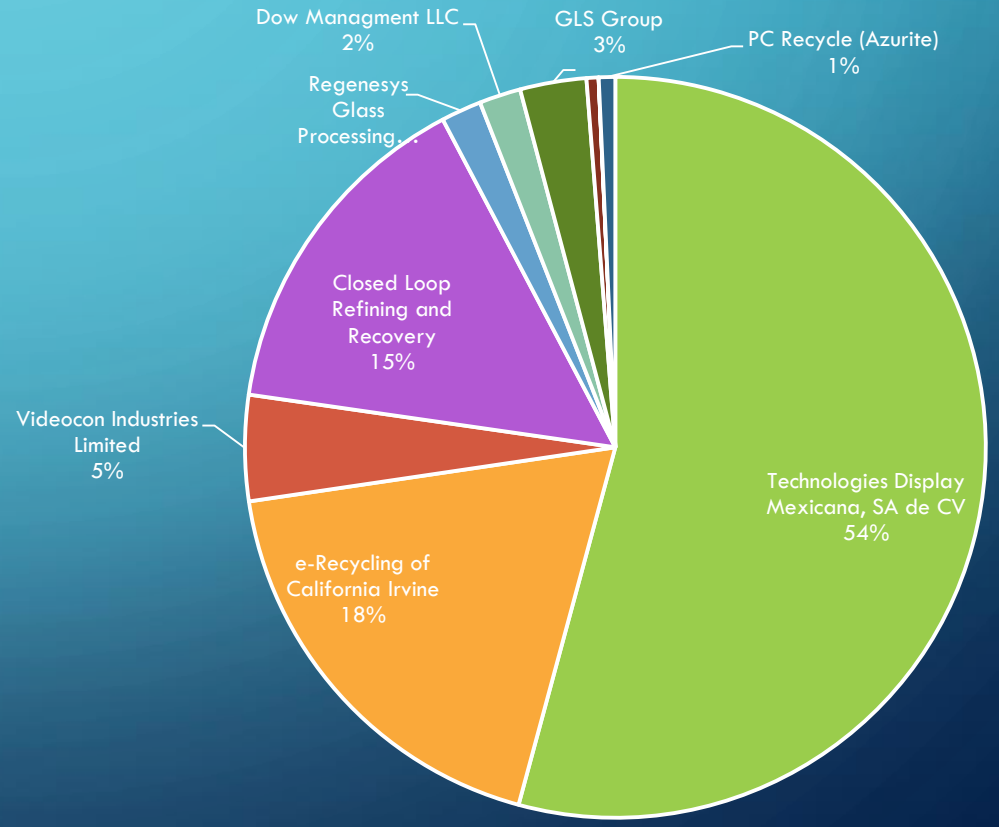
Xstrata PLC

INITIAL DESTINATIONS IN 2012 & 2013

2012 Shipments by Destination (112M total)

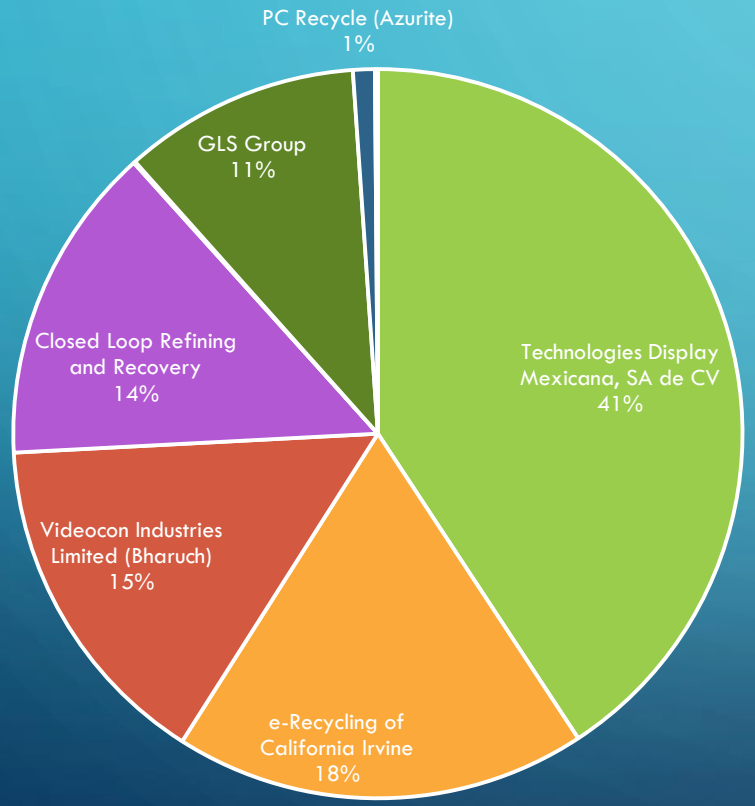


2013 Shipments by Destination (106M total)

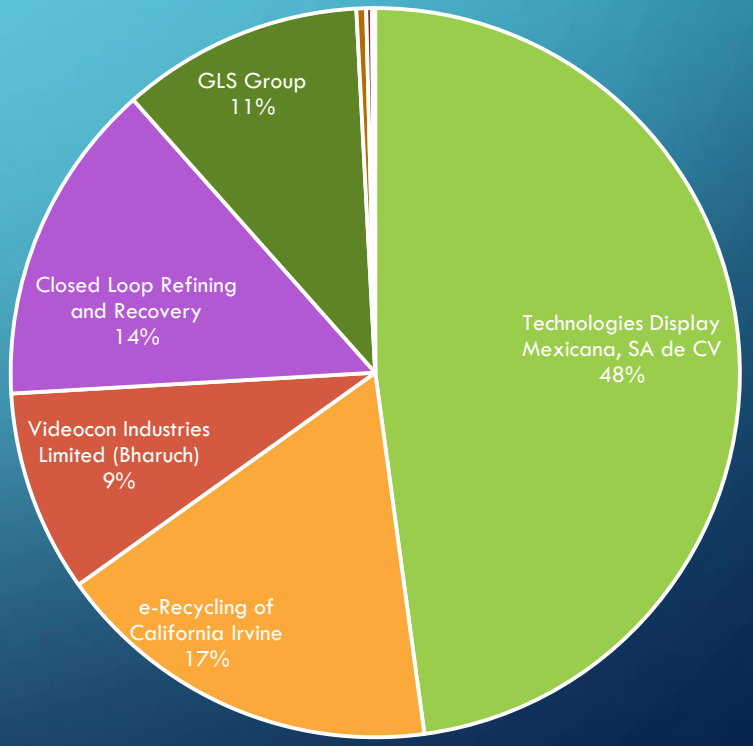


INITIAL DESTINATIONS IN 2014 & 2015

2014 Shipments by Destination (102M total)

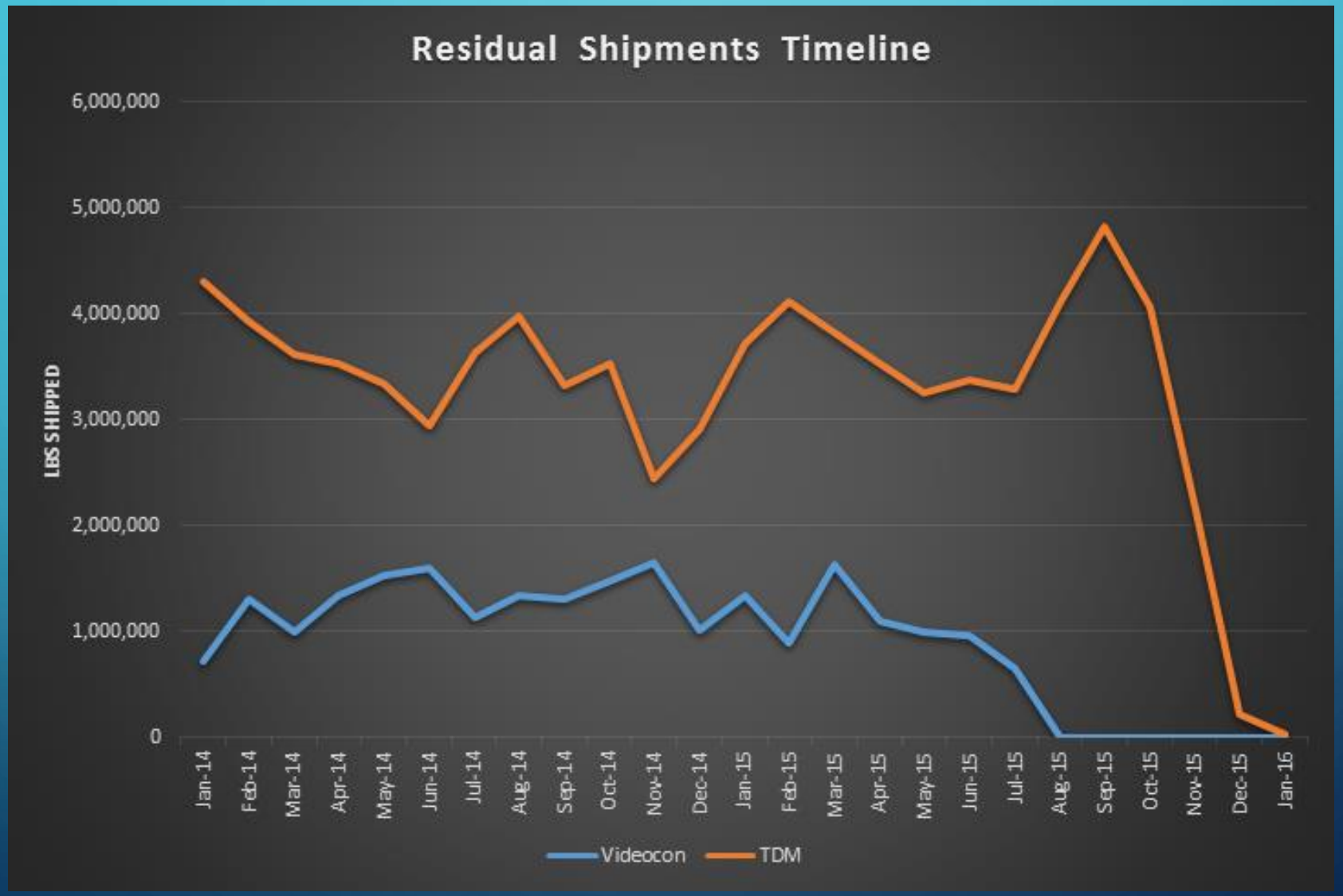


2015 Shipments by Destination (85M total)



INITIAL DESTINATIONS IN 2014 & 2015

DIRECT TO *VIDEOCON* VS *TDM*



DTSC'S EMERGENCY CRT RULES

Adopted in Oct 2012 and Readopted in Sept 2014

- Significant public focus / concern on disposal allowances
- More important: DTSC can demand disposition documentation
  - Using CalRecycle shipping data, DTSC able to force redirection of CRTs abandoned in Yuma

Emergency rules created options for CEW recyclers

- New options came with new requirements

CURRENT UNDERSTANDING OF THE CRT LANDSCAPE BY THE ELECTRONICS RECYCLING COMMUNITY

ASSEMBLED BY U.S. EPA, SEPTEMBER 2014

SOURCES

Import • Households • Businesses • Governments • State Programs

FACTORS

- No legal requirement in many states to recycle electronics
- Inconsistent state laws
- Products with no OEM in existence
- CRTs are big and heavy and inconvenient to recycle
- CRT rule doesn't apply to households
- Consumers may be unwilling to pay to recycle if disposal is cheaper
- Technology change (CRTs replaced by flat panel)
- With EPR laws, responsibility for disposition of CRTs has shifted from consumers to manufacturers (Note: this has different perspectives.)
- Regional variation in collection systems
- "Cherry picking" high-value parts lowers value down the chain
- Economic incentive needed to recycle
- Broken CRTs harder to recycle
- Enforcement needed against illegal disposal by generators

CRT Problem Statement

CRTs and CRT glass were once easily recycled into new CRTs; however, the demand for new CRTs has collapsed in favor of new flat panel technologies.

Because of rising costs, negative economic incentives, and shifts in CRT glass markets, some CRT processors and recyclers are choosing to store the glass indefinitely rather than send it for recycling (or disposal), which increases the risk of mismanagement and/or abandonment of the CRTs.

COLLECTION POINT

OEMs • Municipal Collectors • Recyclers • Retailers

- Thousands of collectors are highly fragmented and hard to organize
- No standard or requirements for a "collector"
- Subsidies and manufacturer payments going to collectors rather than recyclers
- Collectors have no solution for CRT glass
- Breakdown in contracting/auditing for ensuring proper CRT glass disposition
- Recyclers collecting without contracts with manufacturers
- "Cherry picking" high-value parts lowers value down the chain
- Lack of/varying levels of education about CRT regulation in different states
- CRTs are heavy and pose a challenge to ship long-distance
- Inconsistency in state programs
- Lack of up-to-date information for consumers on which collectors will take CRTs
- Hiring of recyclers sometimes leads to funding being split by two recyclers
- Lack of rural route density increases cost per unit
- Bad actors in the industry misrepresenting "air pounds"
- Broken CRTs are harder to recycle
- Shipments out of state can't be regulated by original jurisdiction
- Use of pounds as basis for performance encourages CRTs to be collected
- Ergonomic challenges of managing CRTs—physical wear and tear on people

ELECTRONICS RECYCLER

- Financial incentive for entities to get paid to receive CRTs and then not pay to recycle (or dispose)
- Lack of enforcement of CRT rule by states and EPA
- Lack of tracking of CRTs to final disposition
- Barriers to entry are low
- Lack of awareness about phosphor, silica and lead hazards in the workplace
- Certification is not assurance of compliance or responsible recycling
- Stewardship organizations represent a monopsony and consolidate the control of contracts by selecting vendors. This creates lack of competition, which in certain states raises costs. (Note: this has different perspectives.)
- Recyclers aren't charging enough to cover costs for recycling
- Too many recyclers are exporting CRTs improperly
- Whenever the state manages CRT recycling, it seems issues of mismanagement increase
- Lack of knowledge about outlets for recycling CRTs
- Lack of engagement of glass manufacturers who made the glass
- Lack of adequate closure plans
- Ergonomic challenges of managing materials—physical wear and tear on people
- Costs are high to switch to new technologies
- Lack of clear specs for recycling grade material
- Need to ship trailer loads of CRTs/glass in order to be accepted
- Thin operating margins, insufficient funds held

TREATMENT AND DISPOSAL IN LANDFILL

(HAZARDOUS OR NON-HAZARDOUS)

+

- Large capacity likely

−

- State bans on landfilling CRTs
- Doesn't count toward state recycling obligations
- Cost
- Not environmentally-friendly
- Potential stigma issues

TREATMENT AND USE AS ALTERNATIVE DAILY COVER

AT MUNICIPAL SOLID WASTE LANDFILL

+

- Large capacity likely

−

- Doesn't count toward state recycling obligations
- ADC may be considered a form of recycling by some, which discourages other recycling options for CRT glass
  - (Note: Different perspectives on this point)
- State approval required for use as ADC
- Potential stigma issues

ADVANTAGES + / CHALLENGES −

CERAMICS

+

- Substitute for raw material
- Doesn't require energy to separate lead from glass
- Large global capacity potentially available

−

- Would likely require export
- May not be able to export to non-OECD countries
- Shifts the lead to ceramics, which may create legacy issue
- Proper firing required in order to minimize exposure
- Needs regulatory certainty/acceptance
- Real capacity unknown

GLASS FURNACES

Uses electricity/plasma to separate lead from glass

+

- Smaller and regional in scale; could be co-located with large piles of glass
- Multiple furnaces would lower freight costs
- Lead recovered from CRT glass

−

- Very few in operation
- High energy consumption; lifecycle assessment may be helpful
- Needs longer timeframes to store glass
- Small capacity
- Permitting/regulatory issues
- Disposition of slag

GLASS TO GLASS/CRT MANUFACTURING

+

- There is niche market for CRTs
- CRTs are inexpensive and are more robust equipment for variable power situations

−

- New CRTs will eventually need recycling
- Lack of engagement with the glass manufacturers in recycling options for CRTs
- Declining market

CONCRETE

+

- Huge capacity
- Regional markets

−

- Shifts the lead to concrete products, which may create legacy issue
- Whether treatment process adequately prevents leaching
- Permitting issues
- Potential stigma issues

LEAD/COPPER SMELTER

+

- Existing process in operation
- Regulated
- Large capacity
  - (Note: Different perspectives on this point)

−

- Limited capacity and no growth potential
  - (Note: Different perspectives on this point)
- Lead recovery may not be very efficient
- Disposition of slag
- Air emissions
- Variable commodity prices
- Permitting of new smelters is difficult
- Few smelters in North America accept CRT glass
- Perception of taking in hazardous waste
- Needs longer term storage of glass

CRT REUSE

+

- There is niche market for CRTs
- CRTs are more robust equipment for variable power situations
- Inexpensive compared to LCDs

−

- Low demand in US
- Hard to export; exports can be abused as "sham reuse"
- Wiring diagrams are needed to refurbish
- Reused CRTs will eventually need recycling

RETRIEVABLE STORAGE

+

- Avoids irresponsible speculative accumulation
- Allows material to be held until solutions appear
- Quantify the amount of available feed stock or supply

−

- Funding needed/Need to devise a financial structure to account for recovery
- May create a legacy issue
- Competes with viable recovery technologies
- Hazardous waste permit and regulations may apply
- Seen as a "kick the can down the road" approach

CHEMICAL EXTRACTION

+

- Potentially environmentally friendly process
- Complete recovery of lead

−

- Not operational commercially
- Could be expensive
- Potentially slow and time intensive
- Limited capacity

POSSIBLE CRT MARKETS / DISPOSITIONS ???

- CRT Manufacturing
- CRT Reuse
- Lead Smelting
- Copper Smelting
- Glass Furnaces
- Ceramics
- Fiberglass
- Chemical Extraction
- Concrete
- Retrievable Storage
- ADC
- Disposal

CEW PROGRAM EMERGENCY REGULATIONS

Adopted regulations that allow all legal CRT disposition

- Effective August 2015
- Limits timeframe for ultimate disposition
- Includes disposal
- Pathways to dispositions may be complex

CalRecycle adopted rules under emergency authority

CEW RECYCLING CLAIM STATUS

Statute limits CalRecycle issuing recycling payments:

PRC 42476 *(f) The Department of Resources Recycling and Recovery may pay an electronic waste recycling payment or electronic waste recovery payment only for covered electronic waste that meets all of the following conditions:*

…

(2) The covered electronic waste, including any residuals from the processing of the waste, is handled in compliance with all applicable statutes and regulations.

…

CEW RECYCLING CLAIM STATUS

CalRecycle is:

- Continuing to review all submitted CEW recycling claims
- Withholding ***recycling payment*** on claims in question
- Conferring with DTSC on CRT management compliance issues
- Releasing partial payments that cover the ***recovery payment*** portion of the combined rate
- Pursuing determinations as promptly as possible